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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/693,491	10/27/2003	Shunpei Yamazaki	12732-097002	3131
26171	7590	04/12/2006	EXAMINER	
FISH & RICHARDSON P.C. P.O. BOX 1022 MINNEAPOLIS, MN 55440-1022			RICHARDS, N DREW	
			ART UNIT	PAPER NUMBER
			2815	

DATE MAILED: 04/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/693,491

Applicant(s)

YAMAZAKI ET AL.

Examiner

N. Drew Richards

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 February 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6,25-28 and 31-36 is/are pending in the application.
- 4a) Of the above claim(s) 27,28 and 31-36 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6,25 and 26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☒ Certified copies of the priority documents have been received in Application No. 10/105,282.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Claims 27, 28, and 31-36 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected combination.

In applicant's amendment and response filed 2/14/06, applicant has amended the independent combination claims (27 and 28) so as to include the detail that at least one of the fourth electrode, fifth electrode and sixth electrode comprises copper and presented arguments that in view of this amendment the combination claim should no longer be withdrawn from consideration. Though applicant has not specifically stated so, it appears that applicant is arguing that the restriction requirement between the combination and subcombination should be withdrawn. However, the examiner does not feel that the restriction requirement should be withdrawn and as such claims 27, 28 and 31-36 drawn to the combination are still withdrawn from consideration. The fact that these claims have presently been amended so as to include all the details of the subcombination does not change the fact that claims drawn to the combination which did not require the particulars of the subcombination (original claims 27 and 28) were presented in this case. Original claims 27 and 28 are evidence that applicant believes there is some inventive concept in the combination of elements regardless of the details of the subcombination, and as such the restriction between the combination and the subcombination is deemed proper. Claims 27, 28 and 31-36 are still drawn to the combination, regardless of how much detail of the subcombination is amended into the claims. Thus, claims 27, 28 and 31-36 are still withdrawn from consideration. However,

it is worth noting that if the subcombination claims are eventually found to be allowable, any combination claims that recite all the details of the allowable subcombination would be subject to rejoinder.

The requirement is still deemed proper and is therefore made FINAL.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 3, 5, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzawa et al. (JPPAT 2001-035808, Suzawa) in view of Hibino et al. (JP 2001-010685, Hibino) and Ghandi (VLSI Fabrication Principles Silicon and Gallium Arsenide, copyright 1004 by John Wiley & Sons, Inc., P.552-553).

With regard to claim 1, Suzawa discloses in figure 12 a semiconductor device. Suzawa discloses in figures 6 and 12 a semiconductor layer (601 in figure 6) over an insulating surface (102 in figure 12). Suzawa discloses in figures 6 and 12 a gate insulating film (602 in figure 6) on said semiconductor layer. Suzawa discloses in figures 6 and 12 a gate electrode (118 – 123 in figure 12 and 603b and 604b in figure 6) on said gate insulating film. Suzawa discloses in figures 6 and 12 wherein said semiconductor layer comprises a channel formation region (206, 210, 214, 218, 222, or 228 in figure 12), at least one LDD region (207, 211, 215, 219, 223, or 229 in figure 12)

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in contact with said channel formation region, and a source region (208, 213, 216, 221, or 225 in figure 12) or a drain region (209, 212, 217, or 220 in figure 12) in contact with said LDD region. Suzawa discloses in figures 6 and 12 wherein said gate electrode has a taper shape. Suzawa discloses in figures 6 and 12 wherein said gate electrode comprises a laminate of a fourth electrode (603b in figure 6) and a fifth electrode (604b in figure 6). Suzawa does not teach wherein said gate electrode comprises a laminate of a fourth electrode, a fifth electrode and a sixth electrode. Hibino teaches in figure 3b a gate electrode (12) having a taper shape wherein the gate electrode comprises a laminate of a fourth electrode (13), a fifth electrode (14) and a sixth electrode (15). It would have been obvious to one of ordinary skill in the art at the time of the present invention to form the three layered gate electrode of Hibino in the device of Suzawa in order to provide a low resistance aluminum gate electrode and to prevent erosion of the gate electrode during formation of the device as stated by the English language translation of Hibino (USPAT 6529251) in column 3, lines 14 – 18 (a more specific application of why this is true can be found in column 6, lines 27 – 29 and 39 – 43, as well as column 7, lines 38 – 45). Suzawa with Hibino do not teach at least one of the fourth, fifth and sixth electrode comprising copper. Ghandi teach that it is advantageous to include a percentage of copper in aluminum films used in semiconductor devices. At the time of the invention it would have been obvious to one of ordinary skill in the art to form the aluminum electrode (of Suzawa and Hibino) with some copper included in order to reduce detrimental electromigration effects in the aluminum film. It is noted that

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an aluminum film having a small percentage of copper reads on a layer that "comprises" copper.

With regard to claim 3, Suzawa teaches in paragraphs [0011] that fourth and fifth electrode layers at the top and bottom of a gate stack can comprise W or Ti. Hibino discloses in paragraphs 68 – 69 wherein top and bottom electrode layers in a gate stack comprise Ti, and a middle gate stack layer comprises Al. Ghandi teaches that it is advantageous to include copper in the aluminum film. Therefore, it would have been further obvious in the method of Suzawa with Hibino and Ghandi wherein the fourth conductive film is a conductive film comprising W or a material including W as its main component, the fifth conductive film is a conductive film comprising copper or a material including copper as its main component and the sixth conductive film is a conductive film comprising Ti or a material including Ti as its main Component.

With regard to claim 5, Suzawa discloses in figure 12 said fourth electrode is overlapped with said LDD region through said gate insulating film.

With regard to claim 25, Suzawa discloses in figure 18a wherein said semiconductor device is selected from the group consisting of a computer.

4. Claims 2, 4, 6, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzawa in view of Yudasaka et al. (USPAT 5953582, Yudasaka), Hibino et al. (JP 2001-010685, Hibino) and Ghandi (VLSI Fabrication Principles Silicon and Gallium Arsenide, copyright 1004 by John Wiley & Sons, Inc., P.552-553).

With regard to claim 2, Suzawa discloses in figure 12 a semiconductor device. Suzawa discloses in figures 6 and 12 a semiconductor layer (601 in figure 6) over an insulating surface (102 in figure 12). Suzawa discloses in figures 6 and 12 a gate insulating film (602 in figure 6) on said semiconductor layer. Suzawa discloses in figures 6 and 12 a gate electrode (118 – 123 in figure 12 and 603b and 604b in figure 6) on said gate insulating film. Suzawa discloses in figures 6 and 12 wherein said semiconductor layer comprises a channel formation region (206, 210, 214, 218, 222, or 228 in figure 12), at least one LDD region (207, 211, 215, 219, 223, or 229 in figure 12) in contact with said channel formation region, and a source region (208, 213, 216, 221, or 225 in figure 12) or a drain region (209, 212, 217, or 220 in figure 12) in contact with said LDD region. Suzawa is silent to the impurity concentrations of the LDD, source and drain regions. Yudasaka teaches in figure 26 and column 26, lines 8 – 15 wherein an LDD region (642b) comprises a impurity region for giving one conductivity at a concentration of 1×10^{17} to $1 \times 10^{20} \text{ cm}^{-3}$, and one of said source region (642a) and said drain region (643a) comprises said impurity element at a concentration of 1×10^{20} to $1 \times 10^{21} \text{ cm}^{-3}$ (the disclosed ranges of 3×10^{18} to $1 \times 10^{19} \text{ cm}^{-3}$ and $1 \times 10^{20} \text{ cm}^{-3}$ make the claimed range obvious, see MPEP 2144.05 I). It would have been obvious to one of ordinary skill in the art at the time of the present invention to use the impurity concentrations of Yudasaka in the method of Suzawa in order to use an impurity concentration that is well known in the art for LDD and source/drain regions, respectively. Suzawa discloses in figures 6 and 12 wherein said gate electrode has a taper shape. Suzawa discloses in figures 6 and 12 wherein said gate electrode

comprises a laminate of a fourth electrode (603b in figure 6) and a fifth electrode (604b in figure 6). Suzawa and Yudasaka do not teach wherein said gate electrode comprises a laminate of a fourth electrode, a fifth electrode and a sixth electrode. Hibino teaches in figure 3b a gate electrode (12) having a taper shape wherein the gate electrode comprises a laminate of a fourth electrode (13), a fifth electrode (14) and a sixth electrode (15). It would have been obvious to one of ordinary skill in the art at the time of the present invention to form the three layered gate electrode of Hibino in the device of Suzawa and Yudasaka in order to prevent erosion of the gate electrode during formation of the device as stated by the English language translation of Hibino (USPAT 6529251) in column 3, lines 14 – 18 (a more specific application of why this is true can be found in column 6, lines 27 – 29 and 39 – 43, as well as column 7, lines 38 – 45). Suzawa with Yudasaka and Hibino do not teach at least one of the fourth, fifth and sixth electrode comprising copper. Ghandi teach that it is advantageous to include a percentage of copper in aluminum films used in semiconductor devices. At the time of the invention it would have been obvious to one of ordinary skill in the art to form the aluminum electrode (of Suzawa and Hibino) with some copper included in order to reduce detrimental electromigration effects in the aluminum film. It is noted that an aluminum film having a small percentage of copper reads on a layer that “comprises” copper.

With regard to claim 4, Suzawa teaches in paragraphs [0011] that fourth and fifth electrode layers at the top and bottom of a gate stack can comprise W or Ti. Hibino

discloses in paragraphs 68 – 69 wherein top and bottom electrode layers in a gate stack comprise Ti, and a middle gate stack layer comprises Al. Ghandi teaches that it is advantageous to include copper in the aluminum film. Therefore, it would have been further obvious in the device of Suzawa with Yudasaka, Hibino and Ghandi wherein the fourth conductive film is a conductive film comprising W or a material including W as its main component, the fifth conductive film is a conductive film comprising copper or a material including copper as its main component and the sixth conductive film is a conductive film comprising Ti or a material including Ti as its main Component.

With regard to claim 6, Suzawa discloses in figure 12 said fourth electrode is overlapped with said LDD region through said gate insulating film.

With regard to claim 26, Suzawa discloses in figure 18a wherein said semiconductor device is selected from the group consisting of a computer.

Double Patenting

5. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

6. Claims 1 – 6, 25 and 26 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 3, and 7 of U.S. Patent No. 6,657,260 in view of Yudasaka and Ghandi. Claims 1, 3, and 7 teach all of the claim limitations of Yudasaka, but fail to specifically teach a channel formation region, an LDD region, source/drain regions, and that the gate electrode has a tapered structure. Yudasaka provides teaching for these features and the reasons for combination are obvious to one of ordinary skill similar to the 103 rejections above. Further, claims 1, 3 and 7 of the '260 patent do not teach the gate including copper. Ghandi teach that it is obvious to include some copper in an aluminum film in the semiconductor industry as discusses in the 103 rejections above.

Response to Arguments

7. Applicant's arguments filed 2/14/06 have been fully considered but they are not persuasive.

Applicant has argued that claims 27, 28 and 31-36 should no longer be withdrawn. Applicant's arguments have been considered and are not persuasive as discussed in this Office Action under the "Election/Restrictions" heading above.

Applicant has also argued that the combination of Suzawa with Hibino and Ghandi is not proper since there is no motivation to combine Suzawa and Hibino in the manner set forth in the rejection. This is not persuasive. The rejection provides clear motivation to combine the references as set forth above. As recited in the rejection above, the motivation is in order to provide a low resistance aluminum gate electrode and to prevent erosion of the gate electrode during formation of the device. Restated, it is desirable to provide a lower resistance gate electrode by using aluminum, and it is desirable to use the three layer gate so as to prevent erosion of the aluminum gate during its fabrication. Applicant argues that there would have been no such motivation because Suzawa does not employ an aluminum gate electrode. This is not persuasive as the examiner has not alleged that Suzawa teaches an aluminum gate. Suzawa does not use aluminum, but rather uses higher resistance gate materials such as a laminate of a conducting metal nitride and a Ta, Ti or W metallic film. The rejection relies upon replacing the laminate of Suzawa with the gate structure of Hibino, in order to allow the use of a lower resistance aluminum gate. As taught by Hibino, in order to use the lower resistance gate without eroding the aluminum during fabrication the three layer structure is provided. That is, one would use the aluminum gate of Hibino to provide lower resistance and one would use the three layer structure of Hibino to allow the aluminum to be used without eroding the aluminum during fabrication. Thus, the motivation for

combining Suzawa with Hibino as clearly stated in the rejection is a valid motivation that renders the combination obvious to one of ordinary skill in the art.

Applicant also argues, with respect to claim 3, that neither of the applied references suggests an electrode including copper as its main component. This argument is not persuasive. Claim 3 requires that the fifth electrode is formed of a conductive film comprising copper or a material including copper as its main component. Thus, claim 3 includes two possibilities for the electrode. First, that it is formed of a conductive film comprising copper, or second, that it is a material including copper as its main component. In this case, the prior art as applied teaches the fifth electrode being formed of a conductive film comprising copper. Ghandi teaches the inclusion of copper into the aluminum electrode and provides motivation for doing so. It is noted that the inclusion of even a small amount of copper reads on the claim since the claim merely requires the fifth electrode be a conductive film comprising copper. Even a small amount of copper reads on "comprising copper."

Applicant briefly reiterates these arguments with regard to claims 2, 4, 6 and 26. The arguments are not persuasive for the reasons provided above.

Applicant also argues against the double patenting rejection by stating that the '260 claims, like Yudasaka and Ghandi, fail to teach an arrangement in which a gate electrode includes a laminate of fourth through sixth electrodes. This is not persuasive as claim 3 of the '260 patent clearly recites the gate electrode consisting of a laminate of three films. Though they are not labeled "fourth", "fifth", or "sixth" a laminate of three films is the same as the recited fourth through sixth electrodes.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to N. Drew Richards whose telephone number is (571) 272-1736. The examiner can normally be reached on Monday-Friday 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Parker can be reached on (571) 272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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